

# Platelet-Rich Fibrin (PRF): A New Generation Platelet Concentrate

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## ABSTRACT

Platelet-rich fibrin (PRF), is referred to be second generation platelet-concentrate and has been shown to promote soft tissue healing because it contains autologous growth factors and cytokines which are the responsible factors of regeneration of bone and maturation of soft tissue. PRF is an autologous preparation from patient own blood, it not only decreases the cost of the regeneration therapy but also is less time consuming, both for surgeon and patient. Placement of PRF is less technique sensitive than GTR and bone graft placement for the periodontal therapy.

**KEYWORDS:** Platelet-Rich Fibrin, Growth Factors, Cytokines, Regeneration, Periodontal Therapy

## INTRODUCTION

Platelet-rich fibrin is a second generation platelet concentrate and is defined as an autologous leucocyte- and platelet-rich fibrin biomaterial.<sup>1</sup> Platelet rich fibrin affects cellular activities at genetic and cellular levels.<sup>2,3</sup> PRF membrane consists of a fibrin 3-D polymerized matrix in a specific structure, with the incorporation of almost all the platelets and more than half of leucocytes along with growth factors and circulating stem cells.<sup>1</sup> Ross et al were amongst the pioneers who first described a growth factor.<sup>4</sup> Growth factors are released after activation from the platelets trapped within fibrin matrix and have been shown to stimulate the mitogenic response in the periosteum for bone repair during normal wound healing.<sup>5</sup> Fibrin is the activated form of a plasmatic molecule called fibrinogen.

PRF is much better than other platelet concentrates like PRP due to its ease and inexpensive method of preparation and also it does not need any addition of exogenous compounds like bovine thrombin and calcium chloride. Thus PRF has emerged as one of the promising regenerative materials in the field of dentistry. This article will be make one understand about the novel platelet concentrate PRF, its preparation, clinical applications and advantages and disadvantages over other biomaterials.

## HISTOLOGICAL IMPORTANCE

The reason behind the use of platelet preparations lies in the fact that the platelet a-granules are reservoir of many growth factors that are known to play a crucial role in hard and soft tissue repair mechanism. These include platelet-derived growth factors (PDGFs), transforming growth factor beta (TGF-b), vascular endothelial growth

factor (VEGF), epidermal growth factor (EGF), insulin like growth factor-1 (IGF-1), etc. Platelets also contain biologically active protein and binding of these secreted proteins within a fibrin mesh or to the extracellular matrix can create chemotactic gradients favoring the recruitment of various biological regeneration. Thus the use of platelet rich fibrin is a promising application in the field of periodontal regeneration and can be used in clinical situations requiring rapid healing of wound.

## CLASSIFICATION

From last few years several techniques for platelet concentrates are been invented. However, their applications have been confusing because each method leads to a different product with different biology and potential uses. The platelet concentrates are procured by the process of centrifugation. The final product is formed of mainly of biological regenerative material i.e. platelets and fibrin. On the basis of leukocyte and fibrin content, a classification was given in which platelet concentrates was placed into four categories.<sup>6</sup>

- Pure platelet rich plasma (PRP), such as cell separator PRP
- Vivostat PRF (Vivolution, Alleroed, Denmark)
- Leukocyte and platelet rich plasma (L-PRP)
- Pure platelet rich fibrin (P-PRF)
- L-PRF, such as Choukroun's PRF.

## METHOD FOR FORMATION OF PLATELET-RICH FIBRIN

As Chououran et al described PRF preparation, neither anticoagulant nor bovine thrombin were used and it was just to avoid all the restrictions of French law regarding blood derived product. The protocol for PRF preparation is very simple; however it has to be prepared just

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prior to its use. Requirements:

- Blood collection armamentarium
- Glass test tube (without anticoagulant)
- Table centrifuge.

The main advantages in PRF preparation are the single stage centrifugation. The blood obtained from the subject is placed into the sterile test tube and centrifuged immediately for 10 minutes at 3000 rpm.<sup>7</sup> Others have used 2700 rpm for 12 minutes with similar findings.<sup>8</sup>

The steps involved are as follows:

- Blood specimen is collected or drawn from the patient intravenously(Fig.1).
- The blood specimen is drawn in the test tube and centrifuged immediately(REMI Laboratories) and allowed to spin immediately for the stipulated time (Fig.2, Fig.3).
- Following this the blood sample settles into various layers (Fig.4).



Fig.1- Blood specimen is collected or drawn from the patient intravenously



Fig.2- The blood specimen is drawn in the test tube.



Fig.3-Centrifugation is done immediately for the desired time in centrifuge

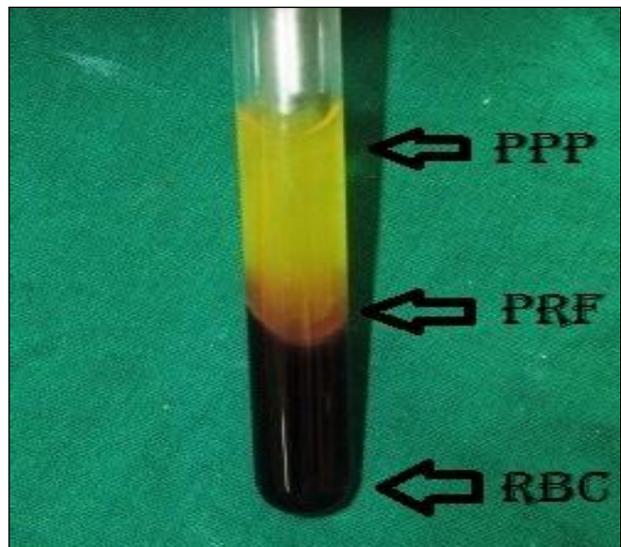


Fig.4-Blood sample settles into various layers in test tube.



Fig.5-PRF is been collected from the test tube and is squeezed off from the lower part containing the red blood cells.

Three different layers are formed which are as follows:

- Red coloured lower fraction containing the RBCs,
- Middle fraction containing the fibrin clot,
- Straw-colored upper fraction contains acellular plasma or platelet poor plasma.

The results of this technique depends on speed of blood collection and its transfer to centrifuge. The upper portion of the test tube contain the acellular plasma which is removed. The middle portion containing the fibrin clot is then removed by the help of tweezer and is been squeezed off from the lower part that contain the red blood cells (Fig.5).

## CLINICAL IMPLICATION OF PRF

Oral application of PRF

- Socket preservation after extraction or avulsion of tooth.<sup>10</sup>
- Filling of cystic cavity.
- In periodontal endodontic lesion.
- In furcation defects.<sup>11</sup>
- Regenerative procedure in treatment of three wall osseous defects.
- In sinus lift procedure.
- Used in gingival recession coverage procedure.<sup>12</sup>
- Used as protection and stabilization of graft material during ridge augmentation procedure.<sup>13</sup>

Extraoral application of PRF

- Repair of articular cartilage defects.<sup>14</sup>
- Used in tendon repair.<sup>15,16</sup>
- PRF can provide significant long-term diminution of deep nasolabial folds.<sup>17</sup>
- Application in various cosmetic, reconstructive and facial surgery<sup>18,19</sup>
  - nasolabial folds,
  - facial volumization,
  - superficial rhytides,
  - acne scars,
  - rhinoplasty,
  - facial esthetic liposstructure,
  - autologous fat transfer,
  - rhytidectomy,
  - depressed scar,
  - dermal augmentation.
- Healing of non-healing ulcers.<sup>20</sup>

## ADVANTAGES

- No need of addition of anticoagulant thereby no biochemical handling of blood.<sup>21</sup>
- Slow natural polymerization leading to favorable healing.<sup>21</sup>
- Standard preparation protocol.<sup>21</sup>
- Simple and cost effective process.<sup>21</sup>
- PRF helps in hemostasis.<sup>21</sup>
- 3-D structure gives elasticity and flexibility to the PRF membrane.

## DISADVANTAGES

- Only limited volume of PRF can be used as it is

obtained from autologous blood sample, the quantity of PRF produced is low and this limits its use for general surgery.<sup>22,23</sup>

- Quick handling is required immediately after collection. The technique entirely depends on the speed of blood collection and transfer to the centrifuge. Even without anticoagulant, the blood sample starts to coagulate almost immediately upon contact within the tube glass. Clinically usable PRF clot is only obtained by its quick handling.<sup>1,2,3</sup>
- The fibrin matrix contains the circulating immune cells and all the highly antigenic plasmatic molecules, that is why PRF is totally specific to the donor.<sup>7</sup>
- Its storage for longer duration is also not possible because of the shrinkage and altering the structural integrity of PRF.

## CONCLUSION

Soft tissue maintenance, wound healing and protecting tissue from bacterial infection is the clinician primary intention. Although PRF belongs to new generation of platelet concentrate and is an autologous preparation from patient own blood, it decreases the cost of the regeneration therapy and also less time consuming, both for surgeon and patient. As the patient's own blood is used the risk of diseases transmitted through blood is reduced or eliminated. PRF contains cytokines, glycanic chains, and structural glycoproteins which are enmeshed within the slowly polymerizing fibrin network. These biochemical components have well known synergetic effects on healing processes. The ease of PRF formation and its application has various beneficial outcomes, which also includes reduction in bleeding, graft stabilization and bone growth. Apart from its application in dentistry PRF is also been used all over the world in various surgeries including orthopaedic surgery and plastic surgery. Still numerous prospective of this new generation platelet concentrate have to be obtained and searched for.

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